But in this country no revolution has been caused in the chemical industry by the introduction of electrochemical methods. Of course, there are various reasons for this; in the first place, cheap power is a *sine qua non* if an electrochemical process is to be satisfactory. Although we have cheap coal, we have very limited supplies of water power. The heavy chemical industry of this country was also in a very secure and flourishing state, therefore there was not much inducement to try the newer methods. On the contrary, in America the chemical industries were not particularly well established. The water power obtainable from the Niagara is immense, although in this connection it should be borne in mind that nearly all the large electrolytic copper refineries are situated near New York, and are worked by steam power; and the progress in America is due in no small measure to the great enterprise and *superior technical training* of the people.

The first part of the volume discusses the question of cost of power production, comparisons being made between water, steam, oil-engine and gas-engine power. It appears in general that water power is the most economical, and gas engines actuated with blast-furnace gas the next. Chapter ii. deals with the Niagara Falls and the distribution of the power, the chief industries being the Aluminium Co. of America, Carborundum Co., Union Carbide Co., Castner Kellner Electrolytic Alkali Co., Oldbury Electrochemical Co., Acheson Graphite Co., and Niagara Electrochemical Co., which take between them about 68,500 h.p. One of the most interesting industries which entirely owes its origin to electrical power is the manufacture of abrasives—carborundum and alundum. There is also the flourishing artificial graphite works. The aluminium works employ about 35,000 h.p., and hold practically the monopoly of the aluminium manufacture in the U.S.A. and Canada. A large part of the power developed from the Niagara is employed for electrochemical purposes on the Canadian side of the falls.

The descriptions of the power obtained from the various falls and rapids is narrated in a very interesting manner. Chapter v. treats of the electric smelting of iron ores and steel production. The electrochemical industries in the Alps, France, and Belgium are also dealt with. In the Alps there are a large number of comparatively small falls, and it says a great deal for the skill of the French engineers that so much use has been made of them, rendering France the chief seat of the electric alloy manufacture. The last chapter describes the electrochemical industries in Great Britain, and anyone reading the book will probably find that there is more work being done in this direction than is generally considered to be the case. The origin of the electrolytic refining of copper was in this country, where it was founded in 1869 by J. Elkington, and the works erected at Pembury, in Wales, are still in operation, although, naturally, they have been enlarged. We congratulate the author upon a very readable and painstaking production.

F. M. P.

NOTES.

WE regret to announce the death, on February 13, of Sir George King, K.C.I.E., F.R.S., late director of the Botanical Survey of India, in his sixty-ninth year; also of Prof. Julius Thomsen, president of the Royal Danish Society of Science, at eighty-two years of age.

A REUTER message from Washington states that the Smithsonian Institution has decided to award the first Langley gold medal to Messrs. Wilbur and Orville Wright.

THE Berlin Academy of Sciences has awarded the Helmholtz medal to Prof. Emil Fischer, for his work on the sugars and albuminoids.

IT is announced that an international exhibition is to be held at Brescia from August to October next under the patronage of the King of Italy.

THE Prehistoric Society of France has elected Dr. A. Guebhard president for 1909; MM. Marot and Viré become vice-presidents, Dr. Marcel Baudouin general secretary, and M. L. Giraux treasurer.

THE *Petit Journal* recently asked its readers to select by their votes twelve great Frenchmen worthy of being included in the Pantheon. Pasteur's name appeared at the top of the poll with 315,203 votes, and was followed by that of Gambetta with 279,443 votes. We wonder whether a man of science would head the list if a similar plebiscite were taken by a popular daily paper in this country.

THE proposed amalgamation of the London Institution with the Society of Arts on the lines of a scheme drawn up by a joint committee in 1905 has been approved by a majority of the proprietors of the former institution. A ballot taken on Monday showed as the result:—for amalgamation, 322; against, 218, the majority in favour thus being 104. The board of management has now to consider whether action shall be taken to carry out the scheme for amalgamation.

THE council of the Royal Society of Arts attended at Marlborough House on February 11, when the Prince of Wales, president of the society, presented its Albert medal to Sir James Dewar, F.R.S., "for his investigations into the liquefaction of gases and the properties of matter at low temperatures, investigations which have resulted in the production of the lowest temperatures yet reached, the use of vacuum vessels for thermal isolation, and the application of cooled charcoal to the separation of gaseous mixtures and to the production of high vacua."

AT the annual meeting of the Royal Astronomical Society on February 12, the following were elected as the officers and council for the ensuing year:—*President,* Sir David Gill, K.C.B., F.R.S.; *vice-presidents,* Sir W. H. M. Christie, K.C.B., F.R.S., Dr. J. W. L. Glaisher, F.R.S., Mr. H. F. Newall, F.R.S., Prof. H. H. Turner, F.R.S.; *treasurer*, Major E. H. Hills, C.M.G.; *secretaries*, Mr. A. R. Hinks, Mr. S. A. Saunder; *foreign secretary*, Sir William Huggins, K.C.B., O.M., F.R.S.; *council*, Mr. Bryan Cookson, Rev. A. L. Cortie, Mr. A. C. D. Crommelin, Mr. A. S. Eddington, Prof. A. Fowler, Mr. J. A. Hardcastle, Mr. H. P. Hollis, Mr. E. B. Knobel, Mr. T. Lewis, Major P. A. MacMahon, F.R.S., Mr. W. H. Maw, Prof. R. A. Sampson, F.R.S.

SEVERE earthquake shocks were experienced again at Messina and in Calabria on February 12 and 13. The *Daily Chronicle* Milan correspondent reports the chief shock as occurring on February 13 at 8 p.m., and lasting for ten seconds, the shock being accompanied by noises like that of cannon during a heavy bombardment. A Reuter's message from St. Petersburg states that a slight earthquake shock was felt on February 13, at 8 a.m., at Sotchi, in the Government of Suchum. Another message from Mexico City reports that the volcano of Colima, near the town of that name, was erupting with increasing violence on February 13. Loud subterranean detonations were heard, and showers of hot ashes fell. A stream of lava a mile long is said to have been emitted from the crater. On February 16 severe earthquake shocks were felt in southern Bulgaria and parts of Hungary.

THE Prince and Princess of Wales were present at the Royal College of Surgeons on Monday, when Mr. Henry Morris, the president, delivered the Hunterian oration, taking as his subject "John Hunter as a Philosopher." The Prince has accepted the diploma of honorary fellow of the college, and on Monday he signed the roll. The president, in the course of his address, said a study of Hunter's works shows that he combined in an exceptional degree the two philosophic methods of induction and deduction. He was essentially a thinker rather than a scholar, yet an experimental philosopher rather than a metaphysician. He saw that for a complete scheme of knowledge induction and deduction are supplementary to each other. His adoption of both inductive and deductive methods was the result of two causes—the natural scope and bent of his mind and the nature of the subjects to which he devoted his life. Induction was largely the method required for the profession he chose. Hunter was a disciple of Bacon in that he employed induction in the pursuit of truth with an ulterior regard to utility and the good of mankind. At the same time he had not the deductive force of Descartes. It was not as a logician, but as an observer and experimenter that Hunter excelled; it was not the beauty of his logic, but the industry with which he collected facts, and the ability and honesty with which he reasoned from them, that made him great.

IT is announced in *Science* that Mr. D. C. Sowers, in charge of the special magnetic expedition to China under the auspices of the Carnegie Institution of Washington, left Peking on January 30. He will be assisted by Prof. Chester G. Fuson, professor of history and geography at the Canton Christian College. The route to be followed by the party will touch at the following places:—Sianfu, Lanchowfu, Suchow, Turfan, Kashgar, Khotan, thence, *viâ* the Karakorum Pass, into India, where connection will be made at Dehra Dun with the magnetic survey of India. Magnetic observations will, therefore, be obtained in parts of China and Chinese Turkestan where no previous data existed. Dr. J. C. Beattie, director of the department of physics, South African College, Cape Town, has been granted a year's furlough in order to take charge of a magnetic survey party under the auspices of the Carnegie Institution. He left Cape Town on November 25 last. His general route of travel will be through German South-West Africa, thence into Rhodesia, British East Africa, German East Africa, and next through Nubia and Egypt, connecting with the magnetic survey of Egypt at Cairo. He will be assisted by Prof. J. T. Morrison, in charge of the department of physics, Victoria College, Stellenbosch, South Africa, who will confine his work chiefly to points reached by steamer along the east and west coasts of Africa. Mr. J. C. Pearson, who during the past year has been engaged in making magnetic observations in various parts of Persia under the auspices of the Carnegie Institution, will be ready some time in March to undertake similar work in Asia Minor, beginning at Bagdad.

MESSRS. H. W. COX AND CO., LTD., of 47 Gray's Inn Road, London, W.C., point out in a circular letter that the exaggerated reports which have appeared consequent upon the sufferings of some of the earliest workers with Röntgen rays (including Mr. Cox himself) have affected not only the English manufacturer and the medical man who were sufficiently enterprising to take up the new treatment, but also to a considerable extent deprived the public of the benefit of the discovery which has been of such incalculable value in the relief of suffering and the advancement of medical knowledge. It should now be well known, however, that apparatus has been devised which entirely obviates any danger either to the patient or to the operator, while experiments have determined the maximum exposure which may be given with safety to the human skin. The rays are now used with perfect safety in thousands of hospitals throughout the world in the treatment of various diseases. Mr. Mackenzie Davidson long ago exhibited at the Röntgen Society the method of protection from the injurious effects of X-rays advised by him. It simply consisted of a wooden box thickly coated with red and white lead mixed into a thick paste—this hardened, and was a non-conductor. A circular opening was left opposite the antikathode. Thus everyone was protected from these rays except the patient who was placed in the path of the rays. Further, the viewing fluorescent screen should be framed and covered with thick and heavy plate glass, which does not interfere with the screen except to protect it (as the glass does a framed picture), and shields the observer from injurious rays. Had these simple precautions been carried out, we should not be grieved by these maimed martyrs. Of course, any material of sufficient atomic weight can be used to enclose the X-ray tube.

A COPY of the annual report for the year 1908 of the council of the Philosophical Institute of Canterbury, N.Z., has been received. During the year arrangements have been under consideration for the publication of the report of the expedition to the subantarctic islands of New Zealand, which took place in 1907 under the auspices of the institute. The expedition was assisted by the Government, and 500*l*. was received from the same source towards bringing out the report on the expedition. Other important questions which have occupied the attention of the council include experiments in connection with Arthur's Pass Tunnel, the foundation of a library of Antarctic literature, the dispatch of a scientific party to the Chatham Islands, and the more adequate protection of native fauna. The Government of the Dominion of New Zealand has made a grant of 200*l*. towards the earth-temperature observations at Arthur's Pass Tunnel, and we notice the council puts on record its indebtedness to Prof. Heim, of Zürich, for the help and advice he has rendered the subcommittee in charge of these experiments. The council recommends that a party of men of science be sent at the first opportunity to the Chatham Islands to make collections of articles of ethnological interest and of specimens of the subfossil bird remains. In connection with the protection of native fauna, it has been decided to direct the attention of the Minister of the Interior to the fact that neither the kaka nor the tuatara is protected, though the export of specimens of the latter is forbidden.

THE Journal of the Royal Sanitary Institute for February (xxx., No. 1) contains a valuable paper by Dr. Rideal on the purification of water by ozone by the De Frise process, which is considered to give extremely satisfactory results.

IN the Bulletin of the Johns Hopkins Hospital for January (xx., No. 214) another paper on the history of medicine is added to the series already published in this journal, the subject being John James Wepfer, a Renaissance student of apoplexy, contributed by Dr. John Donley.

THE Royal Commission on Tuberculosis recently issued a third interim report (Cd. 4483, price 4*d*.). In their second interim report the commissioners expressed the opinion that a considerable amount of disease and loss of life, especially among infants and children, must be attributed to the consumption of cows' milk derived from tuberculous udders and containing tubercle bacilli. The present report contains an account of experiments which have been carried on regarding the infectivity of the milk and fæces of cows which have contracted the disease in the ordinary way. None of the cows investigated showed any sign of tuberculosis of the udder during life, and one only *post-mortem*, yet the milk of these cows contained tubercle bacilli. It was also found that cows affected even with slight tuberculous lesions discharge tubercle bacilli in small numbers in the fæces; those with extensive tuberculous lesions of the lungs or alimentary tract may discharge large numbers of bacilli from the mouth or nostrils in coughing or in the fæces. Since dirt of various kinds from the cow-sheds is almost constantly present in milk as it reaches the consumer, another possible mode of human infection is indicated.

THE greater part of the January issue of the *Museums' Journal* is occupied by papers on the Norwich Museum Association and on a new method of keeping Lepidoptera, both of which were read last year at the Ipswich conference. The system of keeping butterflies and moths, which Mr. S. L. Mosley claims to possess great advantages, is based on devoting a separate box—made in book-form—to each species, with all its phases and variations, as well as illustrations of its natural surroundings and maps of its distribution. The boxes can be arranged on shelves like books.

PROF. RINA MONTI, writing in the Lombardy *Rendiconti*, xli., 18, discusses the active and passive migrations of the fauna of the Italian Alpine lakes. The author finds that on the south side of the Alps the migrations from valley to mountain should have been less easy at the end of the Glacial epoch than at present, on account of certain geohydrographical considerations which he has examined. The passage of boreal types from north to south must necessarily have taken place through depressions in the dividing chain, and the author advances arguments against the hypothesis of an active migration. In several lakes of recent origin of the Ruitor, formed by the regression of glaciers, the author finds that the fauna have migrated from neighbouring basins.

THE whole of the first part, comprising 170 pages of text and twenty-four plates, of the fifth volume of the Zoological Publications of the University of California is devoted to the results of a biological survey, by Mr. Joseph Grinnel, of the San Bernadino Mountains of southern California. These mountains, in the restricted sense of the term, form the most extensive high range in the south of California, and include the highest peak to the south of Mount Whitney. As a large portion is clothed with forest, while the range is isolated from any other mountain-group of approximately similar altitude, the area is one which might naturally be expected to yield results of considerable biological interest. The author paid particular attention to the division of the range into vertical life-zones, which include the Upper and Lower Sonoran, the Transitional, and the Boreal. It was found, as might have been expected, that the flora afforded by far the better data for the delimitation of these zones. Among the special features in the habits of the fauna is the fact that the birds which have bred in the spring and early summer at comparatively low levels are compelled in July to move higher up the mountains in order to escape the shortage of food which prevails, owing to the drought, in their breeding haunts from the commencement of that month until the end of October. A remarkable mortality among the Audubon's warblers was also noticed in December and January; as all these were in an emaciated condition, the lack of proper food would appear to be the cause of the deaths.

DOES the kidney form an internal secretion? is a question upon which physiologists are uncertain. It is stated that extracts of kidney tissue produce a rise of blood pressure; but the main experiments relied upon by those who answer the question in the affirmative were performed some years ago by Dr. J. Rose Bradford, in which he showed that, after removal of a large amount of kidney tissue (the whole of one kidney and a considerable piece of the other), dogs exhibit symptoms of malnutrition which cannot be explained by the loss of the external secretion, the urine. Indeed, the volume of the urine, and the amount of urea excreted, are very frequently higher than the normal in such animals. These experiments were repeated by Bainbridge and Beddard at Guy's Hospital on cats, and their findings did not confirm the far-reaching conclusions which were drawn from Bradford's experiments. The symptoms of malnutrition, according to these later observers, are simply those ordinarily found in inanition, and this condition was present in the cats owing to their refusal to take food. Very similar experiments have just been performed by two American observers, Drs. Sampson and Pearce (*Journal of Experimental Medicine*, New York, vol. x., No. 6, November, 1908). They show that in dogs a reduction of the kidney tissue to one-quarter the original amount is not necessarily fatal, and this is a very important discovery in view of the frequency of surgical operations on the kidney. Very extensive removal of pieces of the kidney is followed by rapid healing, and very little effect on the remaining kidney tissue is noticeable. In cases where a fatal termination did take place, there was renal insufficiency, and the animal refused food. The general trend of the results is therefore in favour of the views of Beddard and Bainbridge.

IN the *Contemporary Review* for February Dr. Havelock Ellis discusses the evolution of the feeling of love of wild nature, that is to say, scenery from which man is excluded. He finds the germ of it in the conception of mingled love and horror felt by the savage towards mountain and woodland, the one the natural home of his gods, the other the abode of malevolent spirits. The affection of his votaries for a god of the wild, like Apollo of Delphi, might in process of time extend to his chosen seat. In Europe the love of scenery first appears among the Celts towards the western isles of Scotland. In classical times the charming, luxuriant landscape of Italy was more fitted to win the admiration of men than the terrible and dramatic aspects of Greece. This became more apparent in the days of the Empire, when Nero chose Subiaco as his abode, and Marcus Aurelius retired for meditation to mountain or sea. Early Christian literature shows little sense of this feeling, but the hermits, who in a state of religious exaltation fled to the desert, fostered at least a tolerance of their barren surroundings. The Christians, again, took over from paganism many sites consecrated to the worship of the gods on account of the remarkable character or beauty of their situation, and religious orders, like the monks of the Grand Chartreuse, were obliged to accept grants of barren lands worthless to their owners. The modern taste for wild scenery was the offspring of the Italian Renaissance, which only revived the views of earlier writers, like the younger Pliny. Coming to more modern days, Addison shows an advancing but still incomplete appreciation of Alpine scenery, which was further developed by the solitary, imaginative Gray. It was left to Rousseau, in "La Nouvelle Heloise," to popularise that feeling in Europe, the tradition of which passed on to Wordsworth, Byron, and their many successors. While, then, it is incorrect to regard the love of wild nature as an almost universal human instinct, there is evidence that it was felt by the more imaginative minds from the very earliest times.

MR. D. GRIFFITHS contributes to the annual report of the Missouri Botanical Gardens (vol. xix.) a first series of illustrated studies on the genus Opuntia that acquires additional interest because the plants have been studied in their natural localities. Types of several new species, chiefly Mexican, are described.

WITH the present issue, for February, *Irish Gardening* completes its third year, and may well claim to have fulfilled its purpose of providing a source of information for Irish cultivators. An article of general interest to cultivators of rock gardens, on the subject of suitable dwarf shrubs, is contributed by Mr. J. W. Besant. Attractive colouring of leaves, flowers or fruit, in addition to dwarf habit, are the qualities recommended. The author presents a selection of species from about ten genera, among which *Berberis Wilsonae*, a new introduction from China, *Cotoneaster adpressa*, varieties of *Euonymus radicans, Genista tinctoria, Hypericum moserianum, Potentilla Friedrichsoni*, and *Perovskia atriplicifolia* receive special commendation.

MR. G. A. NADSON contributes to the *Bulletin du Jardin impérial botanique*, St. Petersburg (vol. viii., parts v. and vi.), a short article on the physiology of luminous bacteria, regarding the action of salt in cultural media. Luminosity is produced quickly by using a strong solution containing about 3 per cent. of salt, but a solution containing one-half per cent. eventually produces a more intense light. The following method for obtaining the spores of *Saccharomyces cerevisiae* is recommended by Mr. A. A. Gorodkowa. Sowings of pure yeast are made on plates of agar prepared from a solution containing 1 per cent. each of agar, peptone, and meat extract, a half per cent. of salt, and a quarter per cent. of glucose. The cultures, placed in a thermostat maintained at a temperature of 28° C., should produce spores in three or four days.

ON the question of sense-organs in plants, botanists are primarily indebted to Prof. Haberlandt and Dr. Nemec for original conceptions that have met with considerable, but not universal, acceptation. Arising out of a lecture delivered in Berlin, Prof. Haberlandt has published an article on the subject in *Himmel und Erde* (December, 1908, January, 1909). Three different classes of sense-organs are described, concerned respectively with the perception of mechanical, gravitational, and heliotropic stimuli. The arrangement, in the first case, often consists of a projecting cell or portion of a cell, as in the stamens of *Portulaca grandiflora*; more remarkable is the staminal filament of *Sparmannia africana*, that is notched on the receptive side. The theory that starch grains act as mechanical regulators of gravitational stimulation has aroused much criticism, but has been put to a convincing experimental test by Dr. Francis Darwin. Finally, Prof. Haberlandt submits the arguments in favour of regarding lens-shaped epidermal cells and similar structures in the leaves as apparatus for concentrating the light on the protoplasm, and so regulating the position of the leaf.

THE December (1908) number of the *Journal of Agriculture of South Australia* contains the official estimate of the probable wheat harvest for 1908–9 in South Australia. The total yield is placed at just under 20 million bushels, an average of 11·6 bushels per acre. The corresponding actual figures for last year were a little more than 19 million bushels, with an average of 10·9 bushels per acre. The total area under wheat is estimated at 2,062,000 acres, an increase of 37,000 acres over the previous year, but some of this is grown as a hay crop. The area reaped for grain is placed at 1,727,000 acres, a decrease of 26,000 acres; the area cut for hay is 334,000 acres, an increase of 63,000 acres.

THE report on the Botanic Station, Agricultural School, and Experiment Plots of St. Lucia, recently issued by the Imperial Commissioner of Agriculture for the West Indies, shows satisfactory progress. A large number of economic plants have been raised, and nearly 75,000 were distributed, including lime plants, which were most in request, cacao, rubber, the demand for which fell off, mangoes, oranges, &c. Experiments are recorded on cultivation and spraying; it was found that lime trees could be sprayed with an emulsion of kerosene sufficiently strong to destroy the orange snow scale (*Chionaspis citri*) without themselves suffering any harm.

THE varieties of potatoes grown in the Central Provinces of India are described by Mr. G. Evans in a bulletin issued by the Department of Agriculture for the Central Provinces. Until four or five years ago the Moolki variety was the only one grown in certain districts, and there is evidence to show that it had been grown for nearly 100 years without change of seed or climate; it is now, however, said to be "worn out," and rapidly succumbing to attacks of disease, &c. Potatoes are not uncommonly displacing sugar-canes, and are found to be more profitable.

IN vol. xxiii. of the *Queensland Geographical Journal* Mr. H. R. Mathews, without any reference to, and apparently quite independently of, the papers by Mr. N. W. Thomas in vols. xxxv. and xxxvi. of the Journal of the Royal Anthropological Institute, discusses the methods of navigation among the aborigines of Australia. He dismisses the catamarans and dug-outs used in Cape York Peninsula, Port Darwin, and other northern parts of the continent because he refuses to admit that they are of Australian origin, and attributes the introduction of these types to Malays or Papuans, the former race being probably responsible for the more elaborate decoration of bark canoes in the same territory. It is not quite clear whether he intends to found any ethnological speculations on the fact that the custom of men swimming and towing rafts is found at Macquarie Harbour, on the western coast of Tasmania, and at Peterson Bay, in North Australia. It seems obvious, however, that this is a device which, like the materials and forms of the rafts in use at these places, 1800 miles apart, might be independently discovered by natives employing these primitive methods of navigation.

THE extensive literature dealing with American basketry unfortunately seems to be little known among art students and managers of industrial schools in this country, yet both these classes might with advantage consult it in their search for new schemes of decoration and for instruction in the technique of an art which has been brought to such a high degree of perfection by the Indian tribes. The last monograph on the art, as practised by the Pomo tribe in California, is that contributed to the seventh volume of the Publications of the University of California by Mr.

S. A. Barrett. The fibres used, except the bark of the redbud, are drawn from the roots of plants and trees such as the sedge, carex, and pine. For the foundation material the slender stems of the willow are almost exclusively employed, while for the purposes of decoration the use of feathers and beads is one of its most characteristic features. In technique three different methods are in vogue, coiling, twisting, and wicker-work, of each of which there are numerous varieties. The complexity of the patterns, based on simple geometrical elements such as the line, triangle, rectangle, and rhomboid, is remarkable. To these elaborate patterns, each provided with a descriptive title founded upon some real or fancied likeness to some object bearing the same name, this tribe does not, as is the case with many of their neighbours, attach any religious or symbolic meaning. The numerous drawings accompanying this monograph entitle it to rank as an authoritative manual of this interesting form of artistic handicraft.

DR. HERGESELL, president of the International Commission for Scientific Aëronautics, has sent us a preliminary statement of the participation of the various countries in the work of investigating the upper air, from January to the beginning of July, 1908. Ascents were made in the early part of each of those months, with more or less regularity, from thirty-three stations, including two in the United States and one in Egypt, by means of kites, manned, captive, unmanned (registering), and pilot balloons. The latter do not carry instruments, but observations of wind direction at various altitudes are made by watching the balloons with theodolites. The registering balloons at many of the stations reached altitudes exceeding 18,000 metres; at Pyrton Hill (Oxfordshire) altitudes of 19,000 metres, and at Uccle several exceeding 20,000 metres, were attained. In compliance with a decision of the meeting of the commission held at Milan in 1906, an extended series of ascents took place, for the second time, at the end of July, 1908. The full results will be published later; a preliminary notice of some of them was given in our issue of December 31, 1908.

WE have received the Journal of the Meteorological Society of Japan for the months August to November, 1908; abstracts of most of the papers are given in English. The following seem to us to be of especial interest:—(1) Observation of *Givre* in Hokkaido, by Mr. J. Yamada, in the August number. This is one of the terms left to the International Meteorological Committee to define in a precise manner. In the present paper it relates to the phenomenon sometimes called "rime," and which the author explains is formed after fog of some duration, and most frequently with temperatures below −10° C. (2) The relation of barometric pressure to the pulsation of the earth, by Mr. N. Shimono, in the September number. The seismograph at Osaka showed that the oscillations became more frequent as barometric depressions approached, and decreased as they passed away. No relation was found between the wind and the pulsatory oscillation. We regret to note the death of the president of the society, Vice-Admiral Viscount T. Enomoto, which occurred in October last.

AN interesting table showing the efficiency of various kinds of furnaces is given by Mr. J. W. Hall in a paper appearing in the Proceedings of the Birmingham Metallurgical Society for 1907–8. The difference shown between different types of furnaces is very marked. The highest efficiency in ordinary work is attained by an English blast-furnace making pig iron, in which 81·7 per cent. of the total heat given by the fuel is utilised and only 18·3 per cent. wasted. No less than 65·3 per cent. of the total heat, however, escapes from the furnace, but most of this is recovered outside in various ways. In a puddling furnace not fitted to a boiler, 91 per cent. of the heat is wasted, but the most wasteful furnace of all is the common coke crucible furnace employed in melting steel, in which 1·43 per cent. of the heat is used in the furnace and 98·57 per cent. wasted. Other papers printed in full in the Proceedings deal with the selection and testing of foundry irons, the sampling of pig iron, and the microstructure of a cartridge case.

AN important paper on heat-flow and temperature-distribution in the gas engine was read by Prof. B. Hopkinson at the Institution of Civil Engineers on February 2. The author first investigates the probable heat-flow and temperature-distribution and gradients over the cylinder walls, dealing specially with those parts which are not water-jacketed, and then describes some experiments made on a 40 B.H.P. Crossley gas engine in his laboratory at the University of Cambridge. The temperatures at different parts of the piston, which was uncooled, and also of the exhaust and inlet valves, were measured by thermocouples. Under normal working conditions these temperatures were found to be in excess of the jacket-water temperature by 370° C. at the centre of the piston, 400° C. in the exhaust valve, and 250° C. in the inlet valve. It is very unlikely, as shown by Prof. Hopkinson's calculations, that the temperature of the inner side of water-cooled walls ever rises above quite a moderate value. There may be a temperature gradient in the piston face from centre to edge of 180° C., producing inequality of expansion which may give hoop stresses amounting to several tons per square inch. The author gives an interesting investigation of this problem. Experiments were made in order to ascertain the effects on the temperature-distribution of changing the strength of mixture, time of ignition, and degree of compression. An important set of experiments was also made on the phenomena of pre-ignition produced by overheating of part of the metal surface. A long iron bolt was introduced having a thermocouple at its end. The end of this bolt was heated from the explosions, when it was found that pre-ignition would not occur so long as the bolt temperature did not exceed 700° C. If the temperature exceeded 730° C. pre-ignitions occurred so frequently as to pull the engine up. It was found that the line of division between the conditions under which safe and continuous running was possible and those under which the engine was bound to pull up was very narrow, and can be represented by an increase in the gas charge of only 1 per cent.

WE have received from the Société française de Physique a circular directing attention to the advantages offered by the society to its members, who already number more than fifteen hundred. The subscription for members in this country is only ten francs, and for this a member receives the fortnightly abstracts of communications made to the society, and the quarterly bulletin containing the complete papers. By paying three francs extra a member may have the *Journal de Physique* instead of the bulletin, and as the journal contains both the communications made to the society and abstracts of communications made to many other French, British, and German societies, this is a very inexpensive way of being kept up to date in matters physical. There are other advantages of membership which may be learnt from the secretary of the society, 44 rue de Rennes, Paris.

THE only means of measuring very small gas pressures below one-thousandth of a millimetre of mercury has up to the present been the McLeod gauge, the accuracy of which was called in question by the work of Sir William Ramsay more than a dozen years ago. In the January number of the *Verhandlungen der deutschen physikalischen Gesellschaft*, Drs. K. Scheel and W. Heuse, of the Reichsanstalt, describe a manometer they have constructed which allows them to measure small differences of pressure to an accuracy of about 0·00001 millimetre of mercury. The instrument consists of two metal reservoirs of small volume separated from each other by a membrane of copper 26 centimetres diameter and 0·03 millimetre thick, which bends under any difference of pressure in the two reservoirs by an amount proportional to the difference. The movement of its centre is measured by the aid of a Fizeau interferometer. By means of this instrument the authors have verified Boyle's law for air down to a pressure of 0·0001 millimetre of mercury, and have shown that the McLeod gauge will give trustworthy results at these low pressures.

THE Watkins Meter Co., of Hereford, has published a fourth edition of the useful "Watkins Manual of Exposure and Development," by Mr. Alfred Watkins. The little book, which contains an abundance of practical information, is sold at 1*s*. net.

THE fifth annual issue of M. Max de Nansouty's "Actualités scientifiques" has been published by MM. Schleicher Frères, of Paris. The volume contains a series of essays on scientific subjects of current interest, which range over the whole field of natural knowledge. It would be difficult to imagine a more interesting way for the student of science to keep up his knowledge of French, and at the same time revise and extend his acquaintance with recent work in his own particular subject of study. The price of the volume is 3.50 francs.

THE Dorset Natural History and Antiquarian Field Club offer the "Cecil" silver medal, and prize of the approximate value of 5*l*., for the best paper on "The Discovery of Radium: its Probable Origin, Present Development, and Possible Future Use." The competition is open to any person who was between the ages of eighteen and thirty on May 12, 1908, and was either born in Dorset or resided in the county for twelve months previous to that date. Papers should be sent by March 1 to Mr. Nelson M. Richardson, of Montevideo, near Weymouth.

OUR ASTRONOMICAL COLUMN.

INTERACTION OF SUN-SPOTS.—In a paper published in No. 1, vol. xxix., of the *Astrophysical Journal* (p. 40, January), Messrs. P. Fox and G. Abetti discuss a number of observations which lead to the conclusion that in many individual cases, if not in general, there exists a physical connection between different groups of sun-spots.

A preliminary examination of Carrington's and of Spoerer's results showed that the coincidences of longitude in spots of different latitudes were no more numerous than would be called for by the probability of chance coincidence.

An examination of the Rumford spectroheliograms, taking into account, not only the coincidences of spots with spots, but also of spots with disturbed, flocculic, areas, showed that the coincidences were rather more numerous than demanded by chance, but the result was still indefinite.

However, when individual cases were considered, it at once became evident, from an examination of spectroheliograms, that separate spots, in about the same longitude but in opposite hemispheres, were physically connected. One example, illustrated by reproductions, shows the development of a spot (Greenwich, No. 6185) as a northern companion of a southern spot (Greenwich, No. 6184) between May 6 and May 13, 1907.

A more striking interaction is shown by a series of Hα spectroheliograms taken on September 10, 1908, on which violent eruptions are shown in connection with two spots in opposite hemispheres, these eruptions culminating in the gap between the spots being bridged over. Visual observations made during the four hours in which the whole of the display took place showed violent eruptions of hydrogen in the neighbourhood of the spots. Measurements of position indicated that between September 8 and 12 the northern spot advanced 3°·3 in longitude and 1°·7 in latitude towards the southern spot, the latter remaining stationary.

DISTRIBUTION OF THE STARS.—A result having an important bearing on questions relating to the distribution of stars is announced by Prof. E. C. Pickering in Circular No. 147 of the Harvard College Observatory.

An analysis of the Revised Photometry is now being carried out at Harvard, and among other results already obtained the following is held to be of sufficient importance to call for immediate publication.

If the stars were infinite in number and distributed at random throughout space, the number, N, in any given class brighter than magnitude, M, should be given by the formula $N = aM + b$, where $a = 0{\cdot}60$, and b is another constant. A previous determination of a, considering 4000 bright stars, gave the value 0·52, and the deficiency was attributed to the absorption of light by some interstellar medium.

In the present investigation the stars brighter than magnitude 6·50 were divided into six magnitude-groups, and then into two divisions. The one division included the spectral classes A and F (Type i.), the second included the classes G, K, and M (Types ii. and iii.), and it was found that whilst for the first $a = 0{\cdot}60$, for the second its value was only 0·51. From this result it is obvious that in any study of stellar distribution it is essential that the stars must first be classified according to their spectra.

JUPITER'S SEVENTH AND EIGHTH SATELLITES.—In No. 4300 of the *Astronomische Nachrichten* (p. 63, February 2) Sir William Christie publishes an ephemeris for J viii. computed from the elements previously published by Messrs. Cowell and Crommelin. This ephemeris gives the distance Satellite viii.—Jupiter, in R.A. and declination, for every fourth day between January 2 and March 19, the values given for February 19, for example, being −7m. 34·8s. and −4′ 46″. Two photographs taken at Greenwich on January 16 gave the correction +10·3s., +2′ 40″; a second photograph was secured on January 19.

No photograph of J vii. has yet been obtained, every available opportunity having been employed to photograph the more recently discovered satellite. It is understood that an ephemeris for J vii. will appear in the second edition of the American N.A., 1909.

THE ANOMALIES OF REFRACTION.—In determining time by their circumzenithal apparatus, MM. Fr. Nušl and J. J. Frič found a discordance which they attributed to perturbations of the atmosphere lasting over an appreciable period. Whilst the small evanescent anomalies of refraction affected their observations to some extent, it was found that there was a superimposed anomaly the period of which would amount to seconds.

By an ingenious application of photography to their method, they have now succeeded in demonstrating the existence of this second anomaly, and find its period to be of the order of twenty seconds, whilst the amplitude of the movement it causes is about 1″ of arc.

The results, and the methods by which they were obtained, are discussed and illustrated in No. 13, 1908, of the *Bulletin international de l'Académie des Sciences de Bohême*.

THE STORY OF THE TELESCOPE.—In view of the tercentenary of the telescope, Mr. Mee has issued a very interesting little brochure, in which he reviews the more important events in the development of the instrument. He also adds useful lists of observatories, large telescopes, astronomical societies, &c., and tabulates the chief astronomical events since the death of Copernicus in 1543. This work can be obtained from the author, Llanishen, Cardiff, price 6*d*.